

we obtain

$$R_s = \frac{\frac{R \cdot (A + B + G)}{B} + G}{\frac{G \cdot (B + R + r) + BR}{A \cdot (B + R + r) + Br} + 1} - \frac{RA}{B}.$$

If the potential at Z equalled that at W, the formula

$$R_s = \frac{(G + R) \cdot (A + R)}{G + R + A + r}$$

would of course be sufficient.

III. "Measurement of the Internal Resistance of a Multiple Battery by adjusting the Galvanometer to Zero." By HENRY MANCE. Communicated by Sir WM. THOMSON, LL.D., F.R.S. Received January 12, 1871.

The following method of taking the internal resistance of a battery will be found to give excellent results when several cells are to be tested.

Take one element from the rest of the cells and arrange the circuit as in the annexed figure. Connect the poles of the battery under observation by a shunt S, and adjust the resistance of the latter till zero is obtained on the galvanometer.

Let E be the number of cells tested,

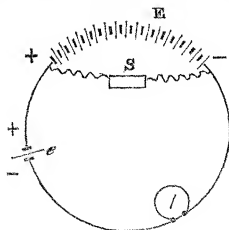
e number of cells opposed,

S = resistance of shunt,

R = internal resistance of E.

Then

$$R = S \frac{E}{e} - S.$$



In practice I usually returned the detached cell to the battery when $S \times E$ gave the internal resistance of the whole within a fraction of a unit.

It is assumed that the electromotive force in e equals that of the whole battery multiplied by $\frac{e}{E}$; the chance of error on account of this not being exactly the case would be lessened by detaching a larger number of cells than one when the internal resistance of the remaining portion would be given by the first formula.